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COMPLETE SPECIFICATION.

Method of and Apparatus for producing Capsules containing Pharmaceutical or Medicinal Material and the like.

I, ALFONSO MARIO DONOFRIO, of c/o McKay-Davis Co., 333, West Woodruff Avenue, in the City of Toledo, County of Lucas and State of Ohio, United States of America, a citizen of the United States of America, do hereby declare the nature of this invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

This application relates to a method of and apparatus for encapsulating various kinds of substances and in particular to a method and apparatus for producing medicinal capsules comprising a gelatinous covering and a small amount of a vitamin concentrate or other pharmaceutical or medicinal material.

The machines employed in the art of encapsulating prior to this invention produce spherical and ellipsoidal capsules through the use of co-acting substantially hemispherical and semi-ellipsoidal dies. In some prior art machines each die is cut in the periphery of a drum or rotating wheel and two such wheels are rotated toward each other with their peripheries contacting and the capsules are formed between the wheels. Forming a capsule in this manner requires that the two wheels be maintained in perfect register so that the sealing action around the rims of the two die pockets functions properly and operates to effectively seal the capsules as they are formed. In other machinery the pockets are formed in co-acting flat die plates and, again, the two pockets forming each capsule must carefully be maintained in registration. This same requirement also is true of a third form of prior art device in which individual capsules are formed from the end of a filled tube of capsulating material by being pinched off the end of the tube. In order to maintain the two pockets of all of these prior art machines in proper registration complex gearing and timing mechanisms or guides and slides must be employed.

It is an object of this invention to provide a method of encapsulating in which symmetrical spherical and ellipsoidal capsules can be produced from two sheets of plastic material, only one of which needs be pocketed.

It is another object of this invention to provide a method of producing a symmetrical spherical or ellipsoidal capsule using only one pocket formed in a single die member, for example, a single rotating die wheel or a single die plate.

It is a further object of this invention to provide an apparatus for forming spherical or ellipsoidal capsules which has only one pocketed die member and, therefore, eliminates the difficult problem of registration between two hemispherical or semi-ellipsoidal die pockets each located in a different die member.

The invention consists in a process for the formation of generally ellipsoidal capsules containing a substance capable of transmitting hydrostatic pressure which process consists in forming pockets in a sheet of capsulating material having a tendency to contract into which pockets measured quantities of the substance are deposited, covering the substance with a flat sheet of stretchable capsulating material and thereafter sealing the two sheets of material together around the edges of the pockets and severing the capsules from the sheets of material.

The expression "substance capable of transmitting hydrostatic pressure" as used herein means any liquid or semi-liquid substance, the shape of which can be modified by pressure and which transmits such pressure in a manner similar to that in which pressure is transmitted by a liquid.

I accomplish the above objects by the practice of the method which will be disclosed either on special apparatus illustrated in the drawings, which constitutes a portion of this invention, or on other apparatus which is well known in the prior art and

illustrated here merely in connection with the explanation of the method of the invention.

In the drawings:

Figure I is a schematic illustration of a form of apparatus constituting a part of the instant invention and on which the encapsulating method of the instant invention can be carried out.

Figure II is a fragmentary vertical sectional view in greater detail and on a larger scale of a portion of apparatus similar to that illustrated in Figure I but embodying a modified die wheel.

Figure III is a fragmentary view in elevation on an enlarged scale of several hemispherical die pockets such as might be employed in the mechanism illustrated in Figure I.

Figure IV is a fragmentary vertical sectional view of a hemispherical capsule immediately after sealing but prior to severance from the material which forms its walls.

Figure V is a vertical sectional view of one type of ellipsoidal capsule manufactured in accordance with the method of this invention.

Figure VI is a plan view of the capsule illustrated in Figure V.

Figure VII is a vertical sectional view of another type of ellipsoidal capsule manufactured in accordacne with the method of the invention.

Figure VIII is a plan view of the capsule illustrated in Figure VII.

Figure IX is a schematic illustration of apparatus for the production of multi-compartment capsules and illustrates how this apparatus also may be employed in practicing the method of the instant invention.

Figure X is a simplified vertical sectional view of a flat die plate as employed in manufacturing capsules in accordance with the method of the instant invention.

Figure XI is a fragmentary vertical sectional view on an enlarged scale of the capsulating plate shown in Figure X and illustrating one step in the method of the instant invention as practiced on this type of apparatus.

Figure XII is a view similar to Figure XI but illustrating a subsequent step in the method of the instant invention.

Figure XIII is a view similar to Figures X and XI but illustrating a still later step in the method of embodying the instant invention.

Figure XIV is a view similar to Figure III but of semi-ellipsoidal pockets which may be employed in accordance with the method of the instant invention for the production of spherical capsules.

Figure XV is a fragmentary vertical section view on an enlarged scale of a semi-ellipsoidal capsule such as would be formed in the semi-ellipsoidal pockets illustrated in Figure XIV and shown before it is severed from the main strips of capsulating material which form its walls.

Figure XVI is a vertical sectional view of a spherical capsule which is the product resulting from the formation of the semi-ellipsoidal capsule shown in Figure XV.

The apparatus schematically illustrated in Figure I is designed for practicing the method of the invention in the production of symmetrical ellipsoidal capsules such as that shown in Figure V.

As explained above, in order to produce a symmetrical ellipsoidal capsule it has been necessary in the past to employ two co-acting die members. In accordance with the instant invention I am able to eliminate one of these two co-acting die members and, therefore to eliminate the necessity for maintaining any of the parts of the machinery on which the method constituting the invention is carried out in perfect alignment or registration with other parts of the machinery. Furthermore, the elimination of one of the die members simplifies the machine, and eliminates a source of failure in operation. As an example of a machine on which the practice of the method of the invention can be carried out there is shown in Figure I a single die wheel 1 which is provided with a plurality of hemispherical die pockets 2 formed in its perphery. The die wheel 1 rotates at a substantially fixed rate of speed on a central hub 3. A sheet 4 of plastic material is led into the machine. In the case of medicinal or pharmaceutical capsules for human consumption this sheet is formed of a gelatinous substance which is soluble in the stomach or intestinal fluids. The sheet passes over one or more feeding rolls 5 and thence up and over the peripheral surface of the die wheel 1. It will be observed that each of the hemispherical pockets 2 has a central port 6 leading inwardly to the inner surface of the die wheel 2 adjacent the outer surface of the hub 3. The hub 3 is ported and has a circumferentially extending slot 7 which is connected with a vacuum line. The circumferentially extending slot 7 is in line with the inner ends of the ports 6 and extends around the periphery of the hub 3 a sufficient distance so that suction is maintained on each of the die pockets 2 for a period during the rotation of the die wheel 1. The sheet 4 of plastic material contacts the surface of the die wheel 1 and as each of the pockets 2 over which it extends approaches the location of a filling shoe 8 its port 6 registers with the slot 7 and vacuum is applied to the die pocket 2. This depresses the material overlying the die pocket forming a hemi-

thicker sheet forming the pocket, which has a tendency to contract, is stronger than the resisting sheet which closes the pocket. Under these conditions it is possible to produce a capsule the shape of which is somewhere intermediate the two shapes shown in Figures V and VII. Theoretically, under these conditions it would be possible to produce a spherical capsule from the hemispherical capsule shown in Figure VI but, as later will be explained, the method of the invention can be used to produce spherical capsules very simply and without requiring a great difference in stress in the two sheets of gelatin.

If the two sheets of gelatin or other capsulating material have different percentages of drying agent, or of solvent, or of moisture, one sheet will tend to dry and shrink more rapidly than the other sheet. This sheet with the greater tendency to shrink and dry is pocketed, and when the capsule is sealed and released the shrinking of the pocketed sheet distends the closing sheet until equilibrium is reached between the forces exerted on the substance in the capsule.

By controlling the relative tendency to contract of the two sheets of capsulating material the resulting shape of the finished capsules can be predetermined and the position of the parting line between the two halves of the capsules can be accurately and positively controlled to fall directly on the center plane of the capsule. However, even if this careful and positive control is not fully maintained almost symmetrical capsules still result inasmuch as the sheets of gelatin tend to approach a spherical shape because, for a given volume, a container of spherical shape has the smallest surface area. Such variations from spherical shape as are desired are accomplished by controlling the extent to and the directions in which the capsule walls are conditioned to contract.

The instant invention contemplates the formation of symmetrical ellipsoidal capsules from two sheets of gelatin only one of which need be pocketed or dimpled in contrast to prior art methods and machines which, in order to form symmetrical ellipsoidal capsules, pocketed or dimpled both sheets of capsulating material. The terms "ellipsoidal" and "generally ellipsoidal" are used to describe all shapes falling generally within their broadest meanings and include not only ellipsoids of revolution on either their shorter or their longer axes but also oblate spheroids, ovals and spheres which are but modifications of the same general form.

The subsequent action of the apparatus shown in Figure 1 is very simple consisting only of passing the web of severed but still retained capsules around a pair of stripping rolls 18 which cause the now ellipsoidal capsules to be pushed out of the web and carry the pierced web away to be returned to the gelatin forming machine. The capsules drop into a pan 19 for cooling and hardening, and are then washed to remove any objectionable film.

In Figure II a more detailed view is shown of a modified form a die wheel which is designed to permit the volumetrical content of the capsules to be varied at will. In this structure a die wheel 20 is provided with a plurality of cylindrical openings 21 extending radially through its outer surface. Each of the openings 21 is surrounded by an annular raised lip 22 identical with the lip 14 formed around the hemispherical pockets in the structure shown in Figure I. Each of the openings 21 is connected through a port 23 to the interior of the die wheel 20 adjacent the periphery of its hub 24.

A plug 25 is variably positionable in each of the openings 21. Each of the plugs 25 is a short longitudinally bored cylinder which has a longitudinally extending rack 26 cut in one side. The rack 26 meshes with an elongated axially extending pinion 27 which is rotatable within an axially extending bore 28 in the die wheel 20. The pinion 27 can, therefore, extend throughout the length of the die wheel 20 meshing with racks cut on plugs in alternate circumferential rows of openings 21. The pinion 27 and all other pinions like it may extend out one end of the die wheel 20 where they can be individually adjusted or all can be driven in unison by a single gear rotatable with respect to the die wheel 20 or by other suitable means (not shown). By thus controlling the radial position of the plugs 25 the depth to which a sheet 29 of gelatin is drawn into the openings 21 and the internal volume of the capsules to be formed can be controlled.

The operation of the apparatus shown in Figure II is identical with the operation of the apparatus shown in Figure I with the exception already mentioned that the volume of the capsules produced thereby can be varied at will. Figure II also clearly illustrates the construction of a filling shoe 30 formed on the end of a tube 31 in communication with a supply of substance to be encapsulated. The bottom of the filling shoe 30 is provided with a beveled flange 32 which has a vertical edge considerably thicker at its forward end than at its rear end and which thus maintains a scraping action over the surface of the sheet of gelatin on which it bears and also maintains a seal around each of the pockets formed in this sheet of gelatin while each pocket is being filled. This is particularly advantageous when the substance to be

spherical pocket in the material itself. As the die wheel continues to rotate the depressed hemispherical pocket passes beneath the filling shoe 8 which is formed on the lower end of a tube 9 connected to a source of filling substance 10. By a pump or other metering means a charge of the substance to be encapsulated is deposited in the pocket beneath the filling shoe 8.

The die wheel continues to rotate moving the filled pocket in the gelatinous material beneath a rotating smooth surface sealing drum 11 around which is fed a second sheet 12 of gelatinous material. The sealing drum 11 is power driven and mounted on an adjustable bracket 13 so that the spacing between its periphery and the periphery of the die wheel 1 can be adjusted to provide sufficient space between the wheel and drum to permit the two sheets 4 and 12 of gelatinous material to pass between the two surfaces but to seal them firmly around the edge of each of the die pockets 2. Each of the die pockets 2 has a lip 14 Fig. III to provide a raised surface against which the two sheets if gelatinous material can be sealed.

As the die wheel 1 continues to rotate the ports 6 of each of the die pockets 2 pass beyond the limits of the slot 7 and suction no longer is applied to the pockets 2. Shortly thereafter each of the formed hemispherical capsules is severed from the sheet of material by passing beneath the smooth surface of a severing drum 15 which is mounted on an adjustable bracket 16 so that it can be properly spaced with respect to the die wheel 1 to pinch off the two sheets 4 and 12 of gelantinous material against the lip 14 of each of the die pockets 2.

At this point in the process the capsules are hemispherical in shape, as shown in Figure IV, and are really severed from the gelatinous material, being maintained in a web formed from the two sheets 4 and 12 of gelatinous material simply by the tackiness of the gelatin. As the die wheel 1 rotates further each of the ports 6 of the die pockets comes in line with a pressure port 17 in the hub 3 which ejects each hemispherical capsule from its die pocket.

The operation of the mechanism shown in Figure I which has been described illustrates the method of the invention for the production of ellipsoidal capsules from two sheets of gelatin or other elastic material which are identical insofar as their elastic and internal physical characteristics are concerned. If the two sheets 4 and 12 are fed into the die wheel 1 as explained and the only stress created in either of the sheets of material is that created by the pocketing of the sheet 4, the resulting finished capsule will assume a shape approximately that of an oblate spheroid such as is shown in Figures V and VI. This results from the equalization of the stress existing in the pocketed sheet 4 as against the unstressed sheet 12. The hemispherical pocket in the sheet 4 is, of course, formed by stretching the material into the pocket in the die wheel. When the suction on the pocket in the die wheel is released the substance in the formed capsule transmits the hydrostatic pressure created by the stretched sheet 4 to the unstretched sheet 12 and, if the sheets are substantially identical, the resulting deformation of the sheet 12 will be substantially symmetrical with the deformation of the sheet 4. Figure V shows a transverse sectional view of the resulting capsule and Figure VI shows a plan view of this same capsule.

The final form of the capsules produced in accordance with the methods of the invention can be modified at will by changing the physical condition or characteristics of the two sheets of gelatin or other plastic material which form, respectively, the pocket and the closure for the pocket. If, for example, the sheet of plastic material which is to be pocketed is stretched in a circumferential direction with respect to the die wheel, the resulting capsules will be oval, i.e. shaped like an ellipsoid of revolution which is rotated about its longer axis. Such a capsule is illustrated in Figures VII and VIII. In order to produce this capsule by longitudinally stretching one sheet of material, it is necessary only to revolve the two feeding rolls 5 at a constant but lower speed than the die wheel 1. This results in stretching the web of material between the feeding rolls 5 and the die wheel 1 so that when it is pocketed greater stress exists in a circumferential direction than exists in an axial direction (both with respect to the die wheel 1). Thus, when the capsule is ejected from the die pocket and severed from the connecting web of material it contracts to a greater degree in one direction than it does in the other, thus forming an oval capsule. The preliminary stretching plus the stretching that occurs during pocketing conditions the pocketed section for greater total contraction and the resulting greater hydrostatic pressure transmitted by the contents bulges the unstressed sheet 12 to a greater degree transversely to the plane of sealing of the two sheets than if neither of the sheets of gelatin has been preliminarily stretched.

Other ways of providing a higher degree of stress in the sheet of material to be pocketed may be employed. For example, the sheet of gelatin or other capsulating material which is to be pocketed may be thicker than the sheet which is to close the pockets. If this is true, then when the capsules are released by the die wheel the

the capsules have thus been formed they may be ejected from the pockets by admitting pressure to the pockets or otherwise.

Upon ejection the differential stresses existing in the two sheets of capsulating material 48 and 50 equalize and deform the flat sides of the hemispherical capsules to produce symmetrical substantially ellipsoidal capsules, of a shape depending upon the relative tendency to contract of the two sheets.

Figure XIV illustrates the shape of the pockets in either a die wheel or a die plate which may be employed to produce spherical capsules very easily in accordance with the instant invention. Figure XIV shows a fragment of die wheel (in which case it rotates in the direction of the arrow) or plate 52 in which are formed a plurality of semi-ellipsoidal pockets 53. A raised edge 54 surrounds each of the pockets 53. In Figure XV there is shown in cross section a semi-ellipsoidal capsule formed from a pocketed sheet 55 of capsulating material and a flat sheet 56 of capsulating material. In accordance with the invention the pocketed sheet 55 is so treated that there is produced in it greater internal stress than that existing in the sheet 56 and thus, when the semi-ellipsoidal capsule shown in Figure XV is severed from the web of the sheets of capsulating material, the resulting equalization of the stresses produces the spherical capsule shown in Figure XVI.

Elongated ellipsoidal capsules also may be produced in the die pockets shown in Figure XIV by using two sheets of capsulating material neither of which has been preliminarily stressed or treated. In this case, the two sheets have the same tendency to contract before the pocket forming sheet is pocketed and the resulting capsule has a cross section similar to that shown in Figure V and an elevation similar to that shown in Figure VIII. Again, the shape of the finished capsule may be modified by treating the two sheets of capsulating material in different ways as explained above.

The method of the invention is directed generally toward encapsulating substances in symmetrical capsules using only one die member. As has been explained the shape of the resulting symmetrical capsules can be modified from that of a thin oblate spheroid to an almost perfect sphere by the manner in which the sheet of material to be pocketed is treated. Fundamentally, the only necessity to produce a symmetrical capsule from a single pocketed sheet of gelatin or other capsulating material and a flat sheet of a similar material is to fill the pocket or dimple with the substance to be encapsulated, to seal the two sheets of material together tightly around the edges of the pocket and to release the semi or half capsule thus formed from all restraint. The subsequent equalization of the stresses in the two sheets of plastic material produces the symmetrical ellipsoidal form. The relative lengths of the major and minor axes of the ellipsoids and the relative proportions of the finished capsules can be controlled as explained by properly apportioning and directing the stresses which are created in the pocketed sheet of material so that in being equalized against the unstressed sheet of material they will modify and control the resulting shape of the capsule as desired.

This application also discloses apparatus for the practice of the method of the invention which is new in the art and constitutes a machine by which capsules of symmetrical commercially acceptable shapes can be manufactured and which uses only one die member rather than two co-acting juxtaposed die members.

By the practice of this invention and by the employment of the apparatus constituting a part of this invention highly attractive commercially acceptable capsules can be manufactured with considerably more rapidity and facility and considerably less expense than by the processes and apparatus disclosed in the prior art.

The method of the instant invention can be practiced not only on the several forms of apparatus illustrated in the drawings but also on many other forms of apparatus which are known in the art or which might be devised and old apparatus as well as the new apparatus herein disclosed may be modified in various ways to produce resulting modifications in the appearance and content of the capsules produced in accordance with this invention.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is :—

1. A process for the formation of generally ellipsoidal capsules containing a substance capable or transmitting hydrostatic pressure which process consists in forming pockets in a sheet of capsulating material having a tendency to contract into which pockets measured quantities of the substance are deposited, covering the substance with a flat sheet of stretchable capsulating material and thereafter sealing the two sheets of material together around the edges of the pockets and severing the capsules from the sheets of material.

2. A process as claimed in Claim 1 wherein the two sheets of capsulating material have different internal stresses.

3. A process as claimed in Claim 1 or 2 wherein the sheet of capsulating material in which the pockets are to be formed is preliminarily stretched in one direction.

4. A process as claimed in any of the

encapsulated is granular or pasty which, if permitted to remain on the portions of the sheet 29 of gelatin overlying the circular lips 22, might prevent the effective sealing of the sheet 29 of gelatin to a second sheet 33 of gelatin which converges with the sheet 29 beneath a sealing drum 34. This illustrates another advantage accruing from the elimination of the second die wheel of the prior art because only one sheet of gelatin need be so carefully cleaned to prevent failures in sealing while two cleaning controls are required when both sheets of gelatin are pocketed and filled.

Also it can be more clearly seen in Figure II how the raised lips 22 around each of the openings 21 provide a relieved space 35 beneath the two sheets of gelatin 29 and 33 between adjacent openings 21. When the capsules are cut or severed from the sheet of gelatin the remaining web portion of the sheets of gelatin is squeezed into these relieved spaces 35 to permit the severing action to take place against the lips 22.

Figure III is a fragmentary view in elevation of a portion of the die wheel, showing how each lip 14 surrounds its pocket 2. The wheel moves in the direction of the arrow in this figure.

Figure IX illustrates apparatus which is capable of operation for the production of multi-compartment spherical capsules as well as for the practice of this invention. This apparatus is shown operating under the method of the present invention to produce symmetrical ellipsoidal capsules from two sheets of gelatin only one of which is pocketed. In this machine two co-acting die rolls 36 and 37 are driven in synchronism and the machine can be operated to produce two-compartment spherical capsules formed of three sheets of capsulating material 38, 39 and 40 (sheet 40 being shown in broken lines) with the two sheets 39 and 40 forming opposite hemispheres of the sphere and the sheet 38 forming the partition.

Through the use of this same machine and employing only two sheets of capsulating material, for example, No. 38 and 39 the method of the instant invention can be carried out. As in the employment of the machine shown in Figure I, the final shape of the capsule depends upon the relative stresses in the sheets 38 and 39. If they are not preliminarily stressed at all, capsules of oblate spheroid shape result or if they are of different thicknesses, are stretched to a different degree, or if the two sheets incorporate a different amount of a volatile substance, capsules of symmetrical ellipsoidal shapes may be produced. By making only these few changes this machine adapts itself as well to the carrying out of the method embodying the instant invention as do the mechanisms shown in Figures I and II. In the mechanism illustrated in Figure IX, in addition to the co-acting die wheels 36 and 37, there also are provided a pair of dimpling rollers 41 and 42 which force the pocket forming sheets of gelatinous material into the pockets in the die wheels. This may be advantageous when very thin gelatin is employed since the thin gelatin might not withstand the suction without rupturing.

Thus, by the use of the one apparatus shown in Figure IX not only can multi-compartment capsules be produced but also the method of the present application can be performed to produce single compartment, symmetrical substantially ellipsoidal capsules.

Figures X, XI, XII and XIII illustrate a way of carrying out the method of the instant invention employing a single die plate. In Figure X there is shown a simplified cross section of a die plate 43 in the upper surface of which are formed a plurality of die pockets 44. Each of the pockets 44 is connected through a duct 45 to an exhaust line 46. Each of the pockets 44 has a raised edge 47. To produce symmetrical ellipsoidal capsules in accordance with the practice of the instant invention a sheet of gelatinous material 48 may be stretched across the top of the plate 43 (as shown in Figure X) and held in place by a clamping frame 49.

The arrows in Figure X show merely the direction of rotation of the two rollers by means of which the gelatin is moulded to its final thickness. The functioning of these rollers has not been described inasmuch as it is a standard practice in the art.

Depending upon the shape of the finished capsules that is desired, the first sheet of gelatin, or other material, may be given a different internal stress or tendency to contract either in one direction (by stretching, for example) or in all directions in the ways explained. After the sheet 48 of gelatin is clamped suction is applied to the line 46 which depresses the lower sheet 48 into the pockets, as shown in Figure XI. The pockets are then filled with material to be encapsulated and the second sheet of gelatin 50 is laid across the frame 49 (as shown in Figure XI) and clamped in place (as shown in Figure XII) by a clamping frame 51.

The capsules are then sealed and severed from the web formed by the two sheets 48 and 50 either by rolling a roller over the surface of the upper sheet 50 or by squeezing a flat plate down on the upper sheet 50 which seals the two sheets together over the raised edges 47 and severs the hemispherical capsules thus formed from the remaining web of the two sheets 48 and 50 of the plastic capsulating material. During this operation suction is still maintained on the line 46 and the ducts 45. After

preceding claims wherein the pockets formed in the first sheet of encapsulating material are substantially hemispherical in form.

5. A process as claimed in Claim 4 wherein the first sheet of capsulating material is preliminarily stretched in a direction transverse to the longer axes of the desired ellipsoidal capsules.

6. Apparatus for forming generally ellipsoidal medicinal type capsules that consists in a mechanism for feeding a sheet of plastic encapsulating material over a die roll having half capsule pockets in its surface into which pockets the plastic material is depressed and means for feeding a second flat sheet of plastic encapsulating material over quantities of the substance to be encapsulated in the said pockets and for sealing the pocketed and flat sheets of plastic material together around the edges of the pockets and for severing the sealed capsules from the web of the two sheets of plastic material.

7. Apparatus constructed in accordance with Claim 6 in which the means for feeding the first sheet of plastic encapsulating material over the pocketed die roll also acts to stretch such sheet material in a direction extending circumferentially of said die roll to a greater degree than the flat sheet of plastic encapsulating material is stretched in the same direction.

8. Apparatus constructed in accordance with Claim 6 or 7 in which the die pockets in the die wheel are radially extending cylindrical openings having lips which are proud of the periphery of the die wheel, the bottom of each of the openings being formed by a radially adjustable cylindrical plug.

9. A method for producing capsules containing pharmaceutical or medicinal material and the like substantially as described in the Specification.

10. Apparatus for producing capsules containing pharmaceutical or medicinal material and the like substantially as described and illustrated with reference to Figures I to III and Figures IX to XIII of the accompanying drawings.

Dated this second day of May, 1947.

LEWIS W. GOOLD & CO.,
Chartered Patent Agents,
5, Corporation Street,
Birmingham, 2.
Agents for Applicant.

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631,484 COMPLETE SPECIFICATION

3 SHEETS
SHEET 1

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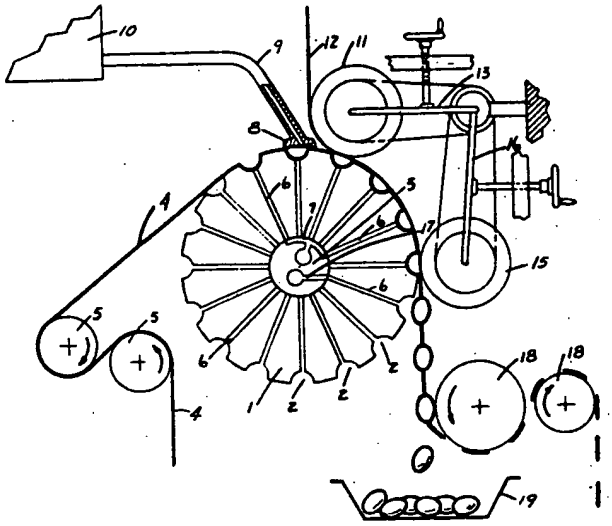

Fig.I

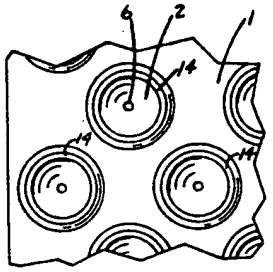

Fig.III.

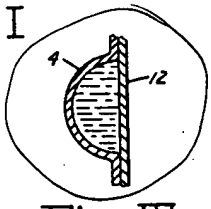

Fig.IV

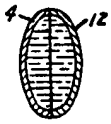

Fig. V

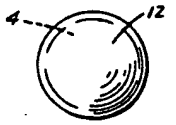

Fig.VI

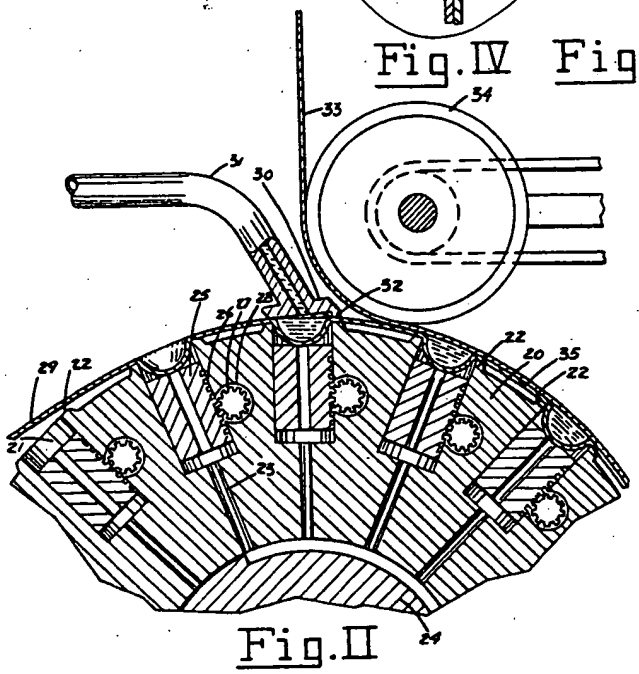

Fig.II

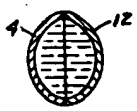

Fig.VII

Fig.VIII

H.M.S.O.(Ty.P.)

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3 SHEETS

SHEET 2

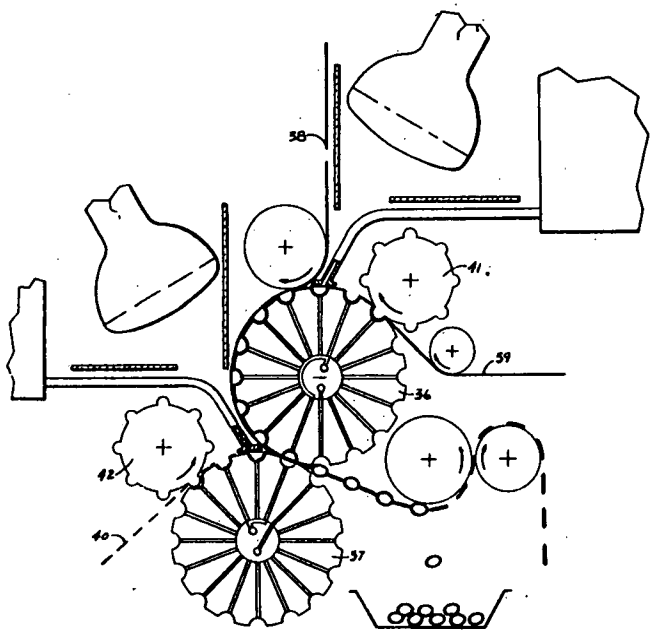

Fig. IX

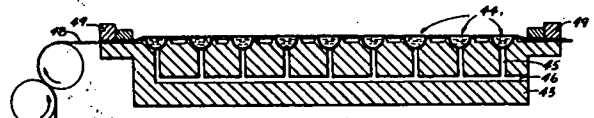

Fig. X

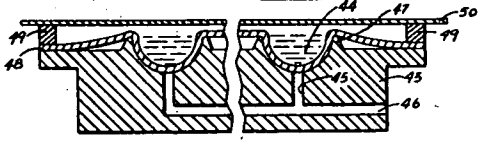

Fig. XI

[This Drawing is a reproduction of the Original on a reduced scale.]

SHEET 3

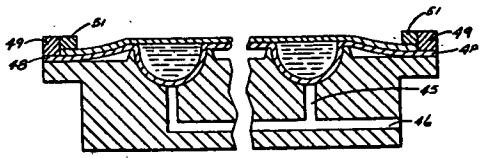

Fig. XII

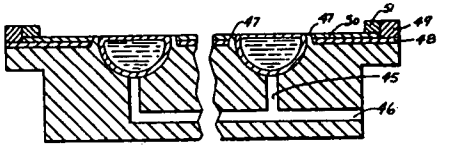

Fig. XIII

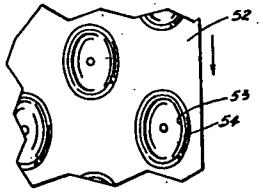

Fig. XIV

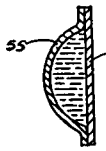

Fig. XV

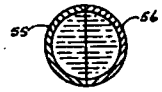

Fig. XVI

H.M.S.O.(Ty.P.)